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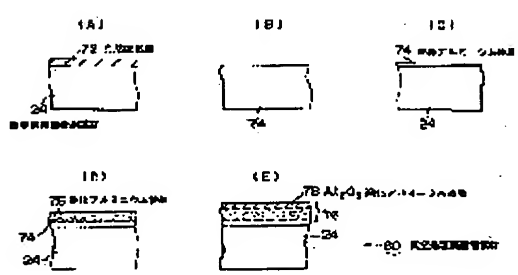
(54) MATERIAL FOR VACUUM PROCESSING DEVICE AND MANUFACTURE



(57)Abstract:

PURPOSE: To form a dense film free from moisture by a method wherein an aluminum oxide film is deposited in a vacuum atmosphere on the surface of a vacuum processing device material where a natural oxide film is removed.

CONSTITUTION: A base material 24 is transferred onto a mounting pad inside a second vacuum processing chamber which is previously kept vacuated by a transfer arm through the intermediary of a load lock chamber which is kept vacuated. That is, the base material 24 is transferred without being exposed to the air so as to prevent a natural oxide film from being formed on its surface. Pure aluminum and aluminum oxide are deposited through a CVD method in the second vacuum processing chamber, wherein a pure aluminum film 74 is formed as thick as prescribed, and then an aluminum oxide film 76 is formed thereon. By this setup, a hard material for a vacuum chamber of low gas emission can be obtained.

CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the base material for vacuum processors characterized by for etching processing having removed the natural oxidation film which forms the base material for vacuum processors with the aluminum alloy containing pure aluminum, and is formed in the front face of this base material for vacuum processors, and constituting after that so that an aluminum oxide may be deposited on the front face of the base material for vacuum processors with which said etching processing was made in a vacuum ambient atmosphere.

[Claim 2] The raw material for vacuum processors characterized by for etching having removed the natural oxidation film of the front face of said base material for vacuum processors, having deposited the aluminum oxide on this front face in the vacuum ambient atmosphere after that in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, and constituting an aluminum-oxide coat.

[Claim 3] In the manufacture approach of the raw material for vacuum processors, the base material for vacuum processors is formed in the shape of a barrel with the aluminum alloy containing pure aluminum. Next, etching processing removes the natural oxidation film currently formed in the internal surface of said base material for vacuum processors, having sealed the ends of said base material for vacuum processors, and maintaining the interior in a vacuum ambient atmosphere. Then, the manufacture approach of the raw material for vacuum processors characterized by constituting so that an aluminum oxide may be deposited on said internal surface, maintaining said interior in a vacuum ambient atmosphere.

[Claim 4] The raw material for vacuum processors characterized by forming in the front face of said base material for vacuum processors the ceramic coat by thermal spraying by which the front face was ground evenly in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum.

[Claim 5] Said thermal spraying is a raw material for vacuum processors according to claim 4 characterized by being a plasma metal spray or detonation flame spraying.

[Claim 6] The raw material for vacuum processors characterized by forming the ceramic coat by detonation flame spraying in the front face of said base material for vacuum processors in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum.

[Claim 7] Said ceramic coat is a raw material for vacuum processors according to claim 6 characterized by grinding the front face evenly.

[Claim 8] Said raw material for vacuum processors is a raw material for vacuum processors according to claim 6 or 7 characterized by being the raw material for electrodes of plasma treatment equipment.

[Claim 9] Said raw material for vacuum processors is a raw material for vacuum processors according to claim 6 or 7 characterized by being the processing container of plasma treatment equipment.

[Claim 10] Said raw material for vacuum processors is a raw material for vacuum processors according to claim 9 characterized by being the base material for configuration members of the components held in said processing container.

[Claim 11] Said base material for configuration members is a raw material for vacuum processors according to claim 10 characterized by being a side-attachment-wall guard plate.
[Claim 12] The manufacture approach of the raw material for vacuum processors characterized by constituting so that the base material for vacuum processors may be formed with the aluminum alloy containing pure aluminum in the manufacture approach of the raw material for vacuum processors, next a ceramic coat may be formed in the front face of this base material for vacuum processors by detonation flame spraying.
[Claim 13] The manufacture approach of the raw material for vacuum processors according to claim 12 characterized by constituting so that the front face of this ceramic coat may be evenly ground after formation of said ceramic coat.
[Claim 14] Said base material for vacuum processors is the manufacture approach of the raw material for vacuum processors according to claim 12 or 13 characterized by being the raw material for electrodes of plasma treatment equipment.
[Claim 15] Said base material for vacuum processors is the manufacture approach of the raw material for vacuum processors according to claim 12 or 13 characterized by being the processing container of plasma treatment equipment.
[Claim 16] Said base material for vacuum processors is the manufacture approach of the raw material for vacuum processors according to claim 15 characterized by being the base material for configuration members of the components held in said processing container.
[Claim 17] Said base material for configuration members is the manufacture approach of the raw material for vacuum processors according to claim 16 characterized by being a side-attachment-wall guard plate.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the raw material for vacuum processors which processes for example, a semi-conductor wafer, and its manufacture approach.
[0002]
[Description of the Prior Art] Generally, in order to manufacture a semiconductor integrated circuit, various kinds of processings, such as membrane formation and etching processing, are performed to a wafer. If it explains taking the case of an etching system as equipment which processes this kind For example, in the vacuum processing container fabricated by aluminum, separate a predetermined gap and a counterelectrode is arranged. Laying the semi-conductor wafer which consists of Si on a lower electrode, and passing the etching gas of for example, Cl system in this processing container, the plasma by high frequency is generated between counterelectrodes, and a wafer front face is etched with the reactant ion to produce. For example, when it has a possibility of etching not only a wafer front face but the side attachment wall of a container since [which is used for the above-mentioned etching gas] corrosive is dramatically strong as for the reactant gas of Cl system, therefore aluminum is used as mentioned above as an ingredient of a processing container, since the corrosion resistance is increased, generally alumite processing is performed to the front face.

[0003]
[Problem(s) to be Solved by the Invention] By the way, when performing vacuum processing to a semi-conductor wafer, before processing in order to avoid mixing with the residual gas in a container, and etching gas at the time of processing initiation, vacuum suction of the inside of a processing container is carried out to a high vacuum condition far lower than a process pressure, for example, 10-5Torr extent, and etching processing is performed, passing etching gas and maintaining a process pressure after that. Therefore, to have in a high vacuum condition as much as possible as one factor for gathering processing effectiveness for a short time is demanded.
[0004] However, if alumite processing is performed to the inside front face of a processing container as mentioned above, generally this alumite processing is formed by anodizing in acid solutions, such as a sulfuric acid, and since sealing by the application-of-pressure steam is moreover performed in order to lessen irregularity of that front face, a lot of moisture will be contained in an alumite coat. Although this alumite coat was excellent in hardness or corrosion resistance, since moisture was included as mentioned above, when vacuum suction of the inside of a container was carried out, this moisture evaporated, gas was emitted, and it had the trouble that it could not have in a high vacuum condition and could not go in a short time.
[0005] This is concretely explained based on drawing 12 and drawing 13 . Drawing showing the system of measurement to which drawing 12 measures the pressure in the vacuum chamber which held the aluminum alloy with which alumite processing of the front face was carried out, and drawing 13 are graphs which show the result of having measured the pressure using the system of measurement shown in drawing 12 .
[0006] While 2 is a vacuum chamber for measurement which consists of stainless steel and the pressure gage 6 is formed in this exhaust air system 4 into drawing 12 , towards that downstream, sequential interposition is carried out and the turbo molecular pump 8 and the rotary pump 10 are constituted possible [vacuum suction]. And the device under test 12 was held in this vacuum chamber 2 for measurement, and the pressure variation when carrying out vacuum suction with the above-mentioned turbo molecular pump 8 and a rotary pump 10 was measured with the pressure gage 6.
[0007] what formed the alumite coat with a thickness of 100 micrometers in the front face of the aluminum alloy which carried out cut finishing as a device under test 12, what performed sealing to this and the thing in which the alumite coat with a thickness of 50 micrometers was formed, and the thing which performed sealing to this -- and only what only carried out cut finishing was used.
[0008] The property when Curve A forming an alumite coat with a thickness of 100 micrometers in drawing 13 , and performing sealing, The property when Curve B forming an alumite coat with a thickness of 100 micrometers, and not performing sealing, The property when the property when Curve C forming an alumite coat with a thickness of 50 micrometers, and performing sealing and Curve D forming an alumite coat with a thickness of 50 micrometers, and not performing sealing and Curve E show the property when performing neither an alumite coat nor sealing only by carrying out cut finishing, respectively.
[0009] When an alumite coat is formed so that clearly from this graph, it becomes clear that much time amount is taken for the rate of a gas evolution to be larger than the case of cut finishing 2-3 or more figures, and to change into the high vacuum condition of 10 to 5 or less Torrs regardless of the thickness and sealing of a coat. Thus, in order to raise hardness and corrosion resistance, when alumite processing was performed to the container inner surface, there was a problem that a high vacuum

condition could not be reached in a short time.
[0010] Furthermore, although not only a wafer front face but the alumite coat of a container internal surface will be slightly shaved in an etching process For this reason, the impurity heavy metal contained in an alumite coat, for example, Fe, (iron), A part for the sulfur contained in Cu (copper), Mn (manganese), Mg (magnesium), Cr (chromium), Zn (zinc), etc. and an acid solution was begun to beat out of the coat, and adhered to the wafer front face, and the trouble of becoming the cause of metal contamination also had it. For example, a metal degree of contamination is 2 1010 pieces/cm by high integration. Although to be the following is demanded, if it is in the above-mentioned alumite coat, it is 2 1012 pieces/cm. It will become the degree of contamination of extent. As for a problem which was described above, quick solution is desired in today when a raise in detailed [of an integrated circuit] and high integration progressed.
[0011] This invention is originated paying attention to the above troubles that this should be solved effectively. The object of this invention is to offer a vacuum housing raw material with few [it is hard and] amounts of gas evolutions, and its manufacture approach.
[0012]
[Means for Solving the Problem] In order to solve the above-mentioned trouble, the 1st invention specified to claim 1 removes the natural oxidation film which forms the base material for vacuum processors with the aluminum alloy containing pure aluminum, and is formed in the front face of this base material for vacuum processors by etching processing, and it constitutes it so that an aluminum oxide may be deposited on the front face of the base material for vacuum processors with which said etching processing was made in a vacuum ambient atmosphere after that.
[0013] In order to solve the above-mentioned trouble, in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, the 2nd invention specified to claim 2 removes the natural oxidation film of the front face of said base material for vacuum processors by etching, after that, deposits an aluminum oxide on this front face in a vacuum ambient atmosphere, and constitutes an aluminum-oxide coat.
[0014] The 3rd invention specified to claim 3 is set to the manufacture approach of the raw material for vacuum processors, in order to solve the above-mentioned trouble. The base material for vacuum processors is formed in the shape of a barrel with the aluminum alloy containing pure aluminum. Next, etching processing removes the natural oxidation film currently formed in the internal surface of said base material for vacuum processors, having sealed the ends of said base material for vacuum processors, and maintaining the interior in a vacuum ambient atmosphere. Then, maintaining said interior in a vacuum ambient atmosphere, it constitutes so that an aluminum oxide may be deposited on said internal surface.
[0015] The 4th invention specified to claim 4 forms in the front face of said base material for vacuum processors the ceramic coat by thermal spraying by which the front face was ground evenly in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, in order to solve the above-mentioned trouble.
[0016] The 5th invention specified to claim 6 forms the ceramic coat by detonation flame spraying in the front face of said base material for vacuum processors in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, in order to solve the above-mentioned trouble.

[0017] In order to solve the above-mentioned trouble, the 6th invention specified to claim 12 is constituted in the manufacture approach of the raw material for vacuum processors so that the base material for vacuum processors may be formed with the aluminum alloy containing pure aluminum, next a ceramic coat may be formed in the front face of this base material for vacuum processors by detonation flame spraying.

[0018]

[Function] Since the 1st invention made the aluminum oxide deposit on the front face of the base material for vacuum processors from which the natural oxidation film was removed in a vacuum ambient atmosphere, moisture is not contained in a coat and it can form a precise coat, its hardness to etching can also be large, and it is excellent in corrosion resistance, and, moreover, can make the raw material for vacuum processors also with few rates of a gas evolution. In this case, as an approach of removing the natural oxidation film, usual etching and the sputter etching in the inside of a vacuum ambient atmosphere can be used. Moreover, the formation approach of an aluminum-oxide coat can use CVD (Chemical Vapor Deposition) in the inside of a vacuum ambient atmosphere etc.

[0019] Since the 2nd invention formed the aluminum oxide coat in the front face of the base material for vacuum processors using the approach of the 1st invention, it not only can also raise the hardness and corrosion resistance over etching, but it can carry out eburnation of the structure of this coat, and the rate of a gas evolution can make it low substantially.

[0020] Since the 3rd invention was made to perform processing which formed the object for natural oxidation film clearance, and the vacuum processing room for aluminum-oxide coat formation, and was mentioned above on the front face using the barrel-like base material for vacuum processors, it does not need to form the vacuum processor only for processings. Thus, the vacuum housing which had few rates of a gas evolution and was excellent in corrosion resistance etc. with the base material for vacuum processors of the shape of a barrel by which inner surface processing was carried out since moisture formed few coats can be formed.

[0021] Since the 4th invention specified to claim 4 is flatly fabricated by forming a ceramic coat by the plasma metal spray or detonation flame spraying, and grinding this front face on the surface of a base material, even if the reaction by-product generated, for example at the time of etching stops being able to adhere to a wall surface easily and adheres to it, it can remove this easily at the time of a maintenance, and can control generating of particle substantially.

[0022] Since the 5th invention specified to claims 6 and 12 formed the ceramic coat by detonation flame spraying in the front face of a base material, it can raise the degree of hardness and porosity substantially as compared with the hard anodic oxidation coatings used conventionally, can improve corrosion resistance, and becomes possible [making the endurance high].

[0023]

[Example] One example of the raw material for vacuum processors concerning this invention and its manufacture approach is explained in full detail based on an accompanying drawing below. First, the 1st and 2nd invention is explained. An explanatory view for drawing 1 to explain the manufacture approach of the raw material for vacuum processors concerning the 1st invention and drawing 2 are the outline block diagrams showing an example of the processor for carrying out 1st invention.

[0024] First, the processor for carrying out 1st invention is explained based on drawing 2 . This processor has two vacuum processing rooms 14 formed with

stainless steel etc., i.e., the 1st vacuum processing room, and the 2nd vacuum processing room 16, and it is connected between these by the load lock chamber 18 which has a conveyance function through gate valves G1 and G2. The 1st vacuum processing room 14 performs etching processing to the base material for vacuum processors which consists of an aluminium alloy in this example, and removes the natural oxidation film currently formed in the front face, and the 2nd vacuum processing room 16 deposits a precise aluminum oxide on the front face by CVD, and forms it.

[0025] Therefore, the 1st vacuum processing room 14 has the up electrode 20 and the lower electrode 22 as an installation base which have been arranged by separating a predetermined gap to that interior, on this lower electrode 22, it consists of an aluminum alloy, for example, the tabular base material 24 for vacuum processors is laid. The aluminum alloy specified as an aluminum alloy in JIS here with 98% or more of purity, also including the ingredient which contains aluminum 100% of abbreviation shall also be included.

[0026] While the above-mentioned up electrode 20 is grounded, many blow-of-gas holes 26 are formed in that underside, and it has the function as the gas shower head, and the etching gas supply system 28 which supplies Cl system gas is connected to this head as etching gas. And sequential interposition of the closing motion valve 32, the massflow controller 30 which controls the flow rate of gas, and the source 34 of etching gas is carried out at this gas supply system 28. here -- as etching gas -- Cl_2, CCl_4, and BCl_3 etc. -- although Cl system gas is used, other reactant gas may be used.

[0027] 13.56MHz RF generator 38 is connected to the above-mentioned lower electrode 22 through the matching circuit 36 which attains stabilization of the plasma to generate, and the plasma is stood between the above-mentioned up electrodes 20. Moreover, the evacuation system 40 between which it was placed by the turbo molecular pump which is not illustrated and the rotary pump is connected to the pars basilaris ossis occipitalis of the processing room 14, and it has come to be able to carry out the vacuum suction of the interior.

[0028] The above-mentioned load lock chamber 18 is equipped with the conveyance arm 42 which can be expanded and contracted inside, and can transport now the base material [finishing / processing] 24 for vacuum processors into the 2nd vacuum processing room 16 in the 1st vacuum processing room 14. Moreover, the evacuation system 44 connected to the turbo molecular pump which is not illustrated at the pars basilaris ossis occipitalis of this load lock chamber 18, either or the rotary pump is connected. On the other hand, the vacuum processing room 16 of the above 2nd has the installation base 46 for laying a base material 24 in that interior, and the heating heater 48 for heating a base material 24 at the time of membrane formation is built in this installation base 46.

[0029] The gas shower head 48 for introducing raw gas into the interior above the above-mentioned installation base 46 is formed, and the raw gas supply system 56 by which sequential interposition of the 1st closing motion valve 52, 1st rate controller 50, and source 54 of raw gas was carried out, and the active oxygen supply system 64 by which sequential interposition of the 2nd closing motion valve 60, the 2nd rate controller 58, and the source 62 of oxygen was carried out are connected to this head 48, respectively. And in the middle of this supply system 64, the oxygen activity machine 68 connected to 13.56MHz RF generator 66 is arranged, and the oxygen which flows in this system can be excited and it can be activated now. As raw gas, a dimethyl aluminum hydride (DMAH), trimethylaluminum (TMA), etc. can be used here. Moreover, the evacuation system 70 connected to the turbo molecular pump

which is not illustrated at the pars basilaris ossis occipitalis of this vacuum chamber 16, either or the rotary pump is connected.

[0030] Next, this invention approach performed using the processor constituted as mentioned above is explained. First, as shown in drawing 1 R> 1 (A), cut finishing of the tabular aluminum alloy is carried out at a predetermined dimension, the base material 24 for vacuum processors is formed so that it may become the components of a vacuum housing assembled eventually, and cleaning processing is performed to this front face. Since this was naturally exposed into long duration atmospheric air, the natural oxidation film 72 of aluminum is formed in the front face of this base material 24. In addition, the front face of it being the front face which will be exposed to a vacuum ambient atmosphere after the assembly for vacuum processors which should be processed from this is natural.

[0031] Thus, after laying the base material 24 by which cleaning processing was carried out on the lower electrode 22 in the 1st vacuum processing room 14 shown in drawing 2 R> 2 and making the inside of this into a predetermined vacuum ambient atmosphere, by driving RF generator 38, the plasma is stood between the upper part and the lower electrode 20, and 22, etching processing is performed to a base material front face, and as shown in drawing 1 (B), the natural oxidation film 72 is removed. etching gas -- Cl2, CCl4, and BCl3 etc. -- independent in Cl system gas -- or it mixes -- making -- using -- ****ing -- a process pressure -- several -- it is carried out within the limits of mTorr - 0.5Torr extent -- since about 100-200A of natural oxidation film 72 is generally formed, etching processing is performed until it removes this thoroughly.

[0032] Thus, if etching processing is ended and the natural oxidation film 72 is removed, this base material 24 will be transferred on the installation base 46 of the 2nd vacuum processing room 16 currently similarly beforehand made by the vacuum ambient atmosphere by the conveyance arm 42 through the load lock chamber 18 currently maintained by the vacuum ambient atmosphere. That is, it conveys, without exposing a base material 24 into atmospheric air, in order to prevent formation of the natural oxidation film. Pure aluminum and an aluminum oxide are made to deposit by CVD first at this 2nd vacuum processing room 16.

[0033] First, only DMAH is indoors supplied from the gas shower head 48 as raw gas, heating a base material 24 to predetermined process temperature, for example, 200 degrees C, at the heating heater 48, and maintaining, and initial deposition is performed. At this time, a process pressure is set for example, as 10mTorr extent, and the active oxygen supply system 64 is closed thoroughly, and suspends supply of active oxygen. In addition, the hydrogen of the specified quantity is also supplied with DMAH. As this shows drawing 1 (C), the pure aluminum coat 74 of 100% of purity abbreviation will be formed in the front face of a base material 24. The coat of aluminum single crystal at this time is formed of the following type.

[0034]

2(CH3)2 AlH+H2 ->2aluminum**+4CH4 **, if only predetermined thickness forms this pure aluminum coat 74 next, the condition of having supplied raw gas as mentioned above -- the 2nd closing motion valve 60 of the active oxygen supply system 64 -- supply of an aperture and active oxygen -- starting -- this amount of supply -- the 2nd rate controller 58 -- gradual -- an increase -- it carries out, and it goes, and as shown in drawing 1 (D) and drawing 1 (E), the aluminum-oxide coat 76 is formed.

[0035] aluminum-oxide aluminum 2O3 in which oxygen was fully contained at the time of formation of this aluminum coat 76 since there were few oxygen contents at

the beginning It does not become. **** -- oxygen -- the aluminum oxide 10O1 liable to lack, for example, aluminum, etc. -- it is formed and an oxygen density goes up -- alike -- following -- for example, aluminum9 O2 ->aluminum8 O3 -> .... aluminum2 O2 ->aluminum 2O3 The amount of content oxygen increases and goes like. And it is aluminum 2O3 of 100% of purity abbreviation eventually. The aluminum-oxide coat 78 will be formed. At this time, it is aluminum 2O3. A coat is formed of the following formulas.

[0036] 2(CH3)2 AlH+3O*+H2 ->aluminum2 O3 **+4CH4 ** (O* shows active oxygen)

The thickness of membrane formation here is aluminum 2O3. The thickness of the aluminum coat 78 sets the thickness of the aluminum-oxide coat 76 whole as about 10 micrometers to several micrometers.

[0037] Moreover, oxygen gas concentration is raised little by little, and the mixing ratio of raw gas and oxygen gas goes so that a final mixing ratio may be set to 4:3. In this case, the capacity of the 2nd vacuum processing room 16 is 5000cm3. When it carries out, in order to obtain DEPORETO (deposition rate) of 1000A / min, the flow rate of DMAH of several 1000 SCCM(s) is passed eventually.

[0038] Thus, by forming the aluminum-oxide coat 76, there is almost no content moisture, and moreover it becomes precise structure, and has stable and sufficient degree of hardness chemically, and the impurity element contained further can also form the raw material 80 for vacuum processors which has very few aluminum-oxide coats 76. Thus, since there are dramatically few rates of a gas evolution of the front face exposed to a vacuum ambient atmosphere by assembling a vacuum housing using the formed raw material 80 for vacuum processors, as compared with the thing of structure, a high vacuum ambient atmosphere can be reached conventionally in a short time. Therefore, it becomes possible for the part and processing effectiveness to increase and to raise a throughput.

[0039] Moreover, when an etching processing container is formed as a vacuum housing, it is hard to be etched from the aluminum oxide coat 76 on the front face of a container being dramatically hard. The oxygen component in a coat can increase gradually and can make the hardness increase from the ability of compactness to be increased further by making active oxygen concentration increase gradually especially. Moreover, since it is conventionally contained in this coat 76 as compared with the case of structure whether impurities, such as heavy metal, are very few even if etched, it becomes possible to control generating of metal contamination substantially. As a result of measuring the impurity in the aluminum-oxide coat 76 formed by this approach, the amount of an impurity is 2 1010 pieces/cm. It was able to become extent and the good result was able to be obtained.

[0040] In the above-mentioned example, in order to remove the natural oxidation film 72, although the usual etching processing was performed, it is not limited to this, for example, sputter etching by Ar gas may be performed. Moreover, on the occasion of membrane formation of the aluminum-oxide coat 76, although DMAH was used as raw gas, it may not be limited to this, but the organic gas containing other aluminum, for example, TMA, may be used, and you may use, not only CVD membrane formation but other membrane formation approaches, for example, PVD membrane formation etc., etc. Furthermore, in this example, although the whole was processed using two vacuum processing rooms 14 and 16, it is not limited to this but may be made to perform etching processing and aluminum-oxide membrane formation processing in the one vacuum processing interior of a room.

[0041] Moreover, as a vacuum housing assembled using the formed raw material 80

for vacuum processors, it is widely applicable not only to the component of the container exposed not only to a vacuum processor but to a vacuum ambient atmosphere, for example, a load lock chamber, a cassette room, and a cluster tool but the structure in a container, for example, the gas shower head made from aluminum, an installation base, etc. In addition, although the case where held the tabular base material for vacuum processors to the vacuum processing interior of a room in the above-mentioned example, and etching and membrane-formation processing were performed to the front face of this base material was explained, the vacuum processing room which should be processed using the base material for vacuum processors of the shape of a barrel which should serve as a vacuum housing eventually forms so that it may not be limited to this but may explain below, and it may be made etching processing and membrane formation giving this internal surface.
[0042] This is explained based on drawing 3 . In addition, the same sign is attached about the same part as the equipment shown in drawing 2 . 24 in drawing is the base material for vacuum processors fabricated in the shape of a barrel with pure aluminum or an aluminum alloy, and will perform etching processing and membrane formation processing of an aluminum oxide to the inner surface of this base material 24.
[0043] Therefore, lids 84 and 86 are formed in the ends of the base material 24 for vacuum processors of the shape of this barrel possible [sealing of the interior] through the seal members 82, such as an O ring, and a processing container is constituted. The evacuation system 70 which interposed the turbo molecular pump 88 grade on the way is connected to one lid 84, and the gas supply nozzle 90 and the active oxygen supply nozzle 92 which have many blow-of-gas holes 26 are inserted in the lid 86 of another side at the airtight, respectively.
[0044] While the above-mentioned gas supply nozzle 90 is grounded, a gas supply system 94 is connected to this. The etching gas supply system 28 which comes to carry out sequential interposition of the closing motion valve 32 for etching gas, a massflow controller 30, and the source 34 of etching gas of Cl system at this gas supply system 94, The raw gas supply system 56 which comes to carry out sequential interposition of the source 54 of raw gas which stores the 1st closing motion valve 52, 1st rate controller 50, and DMAH, the inert gas closing motion valve 98, the inert gas rate controller 96, and N2 etc. -- the inert gas supply system 102 which comes to carry out sequential interposition of the source 100 of inert gas which stores inert gas is connected, respectively.
[0045] On the other hand, the active oxygen supply source 64 which comes to carry out sequential interposition of the oxygen activity machine 68, the 2nd closing motion valve 60, the 2nd rate controller 58, and the source 62 of oxygen is connected to the above-mentioned active oxygen supply nozzle 92. And the 1st switch 104 for turning on and off 13.56MHz RF generator 66 and this is connected to the above-mentioned oxygen activity machine 68 as an energy source which activates oxygen.
[0046] Moreover, sequential connection of the 2nd switch 106 which opens and closes the matching circuit 36, the 13.56MHz RF generator 38 for plasma generating, and this is made at the above-mentioned base material 24 for vacuum processors, this base material 24 is made into ****** material, and it makes inter-electrode [these] generate the plasma by using the above-mentioned gas supply nozzle 90 as an internal electrode. And the heating heater 48 is wound around the perimeter of the above-mentioned base material 24 for vacuum processors, sequential connection of the heating power source 108 and the 3rd switch 110 is made at this heating heater 48, and this base material 24 very thing is heated at the time of membrane formation.
[0047] Next, the manufacture approach of the raw material for vacuum processors

performed using the equipment constituted as mentioned above is explained. First, the case where etching processing of the internal surface of the barrel-like base material 24 for vacuum processors is carried out is explained. First, vacuum suction of the interior is carried out by the evacuation system 70 at the same time it supplies it to the interior like an aperture and the source 34 of etching gas to the 1st invention, using the closing motion valve 32 for etching gas of the etching gas supply system 28 as etching gas, carrying out control of flow of the Cl system gas, and it maintains in the predetermined processing pressure force.
[0048] In addition, it is made for the 1st closing motion valve 52, the inert gas closing motion valve 98, and the 2nd closing motion valve 60 not to supply closing, DMAH, inert gas, and oxygen into a container, respectively at the time of this etching processing. Moreover, the 3rd switch 110 is also changed into an open condition, and makes the heating heater 48 the idle state. And high-frequency voltage is impressed between the barrel-like base material 24 for vacuum processors, and the gas supply nozzle 90 of this core, the plasma is generated inside a container, etching processing of the whole internal surface of a base material 24 is carried out [the 2nd switch 106 is turned ON in such a condition,], and the natural oxidation film is removed. The process conditions at this time are the same as that of the case of the 1st invention, and abbreviation, and this etching processing corresponds to drawing 1 (A) and drawing 1 (B).
[0049] If this etching processing is completed, it will shift to membrane formation processing of an aluminum oxide film next. First, while the 2nd switch 106 is turned OFF and suspending generating of the plasma, closing the closing motion valve 32 for etching gas further and suspending supply of etching gas, the inert gas closing motion valve 98 is opened. thereby -- N2 like -- inert gas is introduced into a container through the inert gas supply system 102 from the source 100 of inert gas, and it is made to permute by the etching gas which remains in this container If the permutation of etching gas is completed, while closing the inert gas closing motion valve 98 and suspending supply of inert gas, the 3rd switch 110 will be closed, it will energize at the heating heater 48, temperature up of the base material 24 for vacuum processors will be carried out to predetermined process temperature, for example, 200 degrees C, and this temperature will be maintained.
[0050] And DMAH and hydrogen gas for membrane formation are introduced for the 1st closing motion valve 52 into a container through the raw gas supply system 56 by open Lycium chinense from the source 54 of raw gas, and an aluminum coat is formed. It is made not to pass the oxygen for activity like the case of the 1st invention in this phase in early stages of membrane formation. Thereby, a pure aluminum coat is formed all over the etched base material internal surface. If the condition at this time is shown in drawing 1 R> 1 (C), it is the same.
[0051] Thus, if a pure aluminum coat with a thickness of about several micrometers is formed, it will supply into a container from the active oxygen nozzle 92, driving the oxygen activity machine 68 and carrying out [turn ON the 1st switch 104,] control of flow of the activated oxygen at the same time it next opens the 2nd closing motion valve 60 and passes oxygen from the source 62 of oxygen. CVD actuation will be performed by this and an aluminum-oxide coat will be gradually formed on the above-mentioned pure aluminum coat.
[0052] An oxygen content is made to increase as the flow rate of active oxygen makes [increase it gradually and] and supplies like the case of the 1st invention at this time and a presser foot and CVD actuation advance the oxygen content to aluminum low in the formation early stages of an aluminum-oxide coat, and it is aluminum 2O3 of

predetermined thickness eventually. An aluminum-oxide coat is made to form. The condition at this time is the same as that of the case where it is shown in drawing 1 (D) and drawing 1 (E). Also in this case, the final flow rate of DMAH and oxygen is the same as that of the 1st invention. Thus, membrane formation of an aluminum-oxide coat is completed and the raw material for vacuum processors is formed.

[0053] And vacuum housings, such as a vacuum processor, a load lock chamber, and a cassette room, will be manufactured using the raw material for vacuum processors of the shape of a barrel formed in this way. Thereby, the raw material for vacuum processors which has a precise and hard aluminum-oxide coat not only with moreover there being few heavy-metal impurities but few rates of a gas evolution can be formed. Since according to such an approach the vacuum processor for etching and membrane formation is formed using the base material for vacuum processors of the shape of a barrel, such as a vacuum processor which should be formed eventually, and it was made to perform etching processing and membrane formation processing to an own wall, it becomes unnecessary to use the special vacuum processor for etching and membrane formation. According to the vacuum processor using the above-mentioned raw material for vacuum processors, as compared with equipment, it could go conventionally that a short time was also to the high vacuum condition of 10-5Torr, and extent of the metal contamination at the time of etching has also been improved substantially.

[0054] In addition, if it was in the above-mentioned example, corrosion resistance and endurance were raised by forming a pure aluminum-oxide coat on the surface of a base material, but it changes to an aluminum oxide, a ceramic coat is formed by detonation flame spraying, and you may make it raise corrosion resistance etc. so that it may explain below.

[0055] Next, the raw material for vacuum processors concerning the 4th thru/or the 6th invention in which the ceramic coat by detonation flame spraying was formed on the base material front face, and its manufacture approach are explained with reference to an accompanying drawing.

[0056] The sectional view showing the vacuum processor assembled using the raw material for vacuum processors which drawing 4 requires for the 4th and 5th invention, The perspective view showing the up electrode used for the equipment which shows drawing 5 to drawing 4 , the perspective view showing the side-attachment-wall guard plate used for the equipment which shows drawing 6 to drawing 4 , An explanatory view for drawing 7 to explain the coating approach of the ceramic coat by detonation flame spraying, the partial expanded sectional view in which drawing 8 shows the mounting section of an up electrode, the partial expanded sectional view in which drawing 9 shows the gas nozzle of an up electrode, and drawing 10 are the partial expanded sectional views showing the mounting section of a side-attachment-wall guard plate. The case where an etching system is taken for an example as a vacuum processor in this example is explained.

[0057] By aluminum etc., it has the processing container 122 fabricated in the shape of a rectangle, and, as for this etching system 120, cylindrical or the susceptor 124 as a lower electrode for laying the semi-conductor wafer W, for example which is a processed object is installed in the interior of this processing container 122 through the insulator 126 on the processing container pars basilaris ossis occipitalis.

[0058] While being grounded, the clamper 128 for holding the periphery section of the laid wafer W mechanically is formed in the periphery of the installation side of this top face, and this susceptor certainly fixes Wafer W on a susceptor 124. While the exhaust air system 130 connected to the vacuum pump which is not illustrated is

connected to the pars basilaris ossis occipitalis of the above-mentioned processing container 122 and making vacuum suction of the interior possible, the gate valve 132 which opens and closes Wafer W at the time of taking out and carrying in is formed in the side attachment wall.

[0059] Moreover, the up electrode 132 of the product made from aluminum for example, which was made to counter with the above-mentioned susceptor 124, and was made by shower head structure is formed (refer to drawing 5), 13.56MHz RF generator 138 is connected to this up electrode 132 through a matching box 136, high-frequency voltage is impressed to the head-lining section 123 of the processing container 122 between susceptors 124, and the plasma is stood to it. Moreover, many blow-of-gas holes 131 for turning the introduced gas to the processing interior of a room, and spouting are formed in the underside of this up electrode 132.

[0060] Besides, the section electrode 132 is fabricated by convex downward, the hollow room 139 is established in the interior, and the etching gas supply way 140 which supplies etching gas to this hollow room is connected. Moreover, in this hollow room 139, in order to diffuse the introduced etching gas in the direction of a flat surface, two diffusion plates 142 and 142 which have many air holes are formed.

[0061] Moreover, inside the side attachment wall of the processing container 122, the ring-like side-attachment-wall guard plate 144 of the shape of a cross section of L characters as shown also in drawing 6 is formed, and the processing container wall is protected from corrosive etching gas so that the processing space S may be surrounded. Many free passage holes 146 are formed in level flange 144A of this guard plate 144, and the ambient atmosphere in the processing space S is efficiently led to the exhaust air system 130 through this. Moreover, the long hole 148 for conveyance for carrying out taking-out close [of the conveyance arm and wafer which are not illustrated] to the above-mentioned side-attachment-wall guard plate 144 corresponding to a gate valve 132 is formed.

[0062] Under the side-attachment-wall guard plate 144 with which this long hole 148 for conveyance is formed, in order to open and close the above-mentioned long hole 148 for conveyance, the shutter member 150 made possible by rise and fall is installed. Thus, the ceramic coat by which it is characterized [of this invention formed of detonation flame spraying] is formed in front faces, such as many raw materials 134 for vacuum processors which touch the processing space S of the etching system constituted, for example, an up electrode, the side-attachment-wall guard plate 144, the shutter member 122, and a processing container side attachment wall. That is, the medial surface of the whole abbreviation for the underside of the lower electrode 134, the whole abbreviation for the front face of the side-attachment-wall guard plate 144, and the shutter member 122 and the paries medialis orbitae of a processing container adhere to the ceramic coats 152A, 152B, 152C, and 152D, respectively. As a ceramic coat, aluminum 2O3, an AlN system ceramic, etc. can be used.

[0063] If detonation flame spraying is explained here, as shown in drawing 7 , the supplied ceramic powder ingredient will be adhered to the front face of a base material 158 at the barrel 154 in the air using the high-speed combustion energy with high heat of combustion which acetylene gas and oxygen are supplied, for example, and these mixed gas is exploded with a spark plug 156, and is produced by this. If mixed gas explodes within a barrel 154, this gas temperature rises at about 3300 degrees C, and ceramic powder can be in a half-melting condition by one about 10 times the rate of acoustic velocity by this toward a muzzle, and combustion gas can crash into a base material 158 by one twice [about] the speed of acoustic velocity, and can form the dogged coating coat of 100 microns of thickness numbers in this

front face. Therefore, a ceramic coat which was described above to each base material can be formed as this base material 158 by using the substrate for the base material for vacuum processors, for example, the base material for up electrode formation, the base material for side-attachment-wall guard plates, and shutter members, and the base material for processing containers.

[0064] As for each ceramic coat, it is desirable after coat formation in the case of the substrate which has the surface smoothness which is like [with possible polish processing], to carry out polish processing of the front face, and to smooth data, and eventually, the thickness of a ceramic coat is set up so that it may be set to 10-400 micrometers, and porosity is set up to 2% or less, in order to control generating of particle as much as possible. Moreover, purity of the ceramic in a ceramic coat is preferably made into 99.5% or more, and the Vickers hardness number at that time carries out to 900 or more. Moreover, when carrying out polish processing of the front face of a ceramic coat, and the difficulty of adhesion of a by-product and the ease of clearance of an affix are taken into consideration, it is desirable to set the surface roughness of a polished surface as 3 micrometers or less.

[0065] Moreover, if the up electrode 134 is taken for an example, processing of the periphery section of the underside of the up electrode 134 joined to the side-attachment-wall up edge of a processing container as shown in drawing 8 will form hard anodic oxidation coatings 160 in the underside periphery section of the up electrode 134 like the conventional approach a little broad beforehand first from the comparatively difficult thing rather than side-attachment-wall up edge junction width of face. In addition, in order to form hard anodic oxidation coatings 160 in this part, it leaves only the hard anodic oxidation coatings 160 which formed hard anodic oxidation coatings in the whole underside of the up electrode 134, next were described above, and you may make it remove the alumite of other parts by cut processing, and may make it form hard anodic oxidation coatings only in an applicable part selectively.

[0066] Next, ceramic coat 152A by detonation flame spraying is formed in the underside of the up electrode 134 by the approach mentioned above in the whole region except the part of hard anodic oxidation coatings 160. In this case, ceramic coat 152A is formed so that it may pile up the about distance L1 slight at the edge of hard anodic oxidation coatings 160, for example, several mm. Thus, by processing, it can prevent that the natural complexion of the aluminum which constitutes the up electrode 134 is directly exposed to the processing space S.

[0067] And the underside of a susceptor 124 and the up electrode 134 which counters performs polish processing to ceramic coat 152A which was easy to perform polish processing since surface smoothness was dramatically high, therefore adhered to this underside. For example, an about 300-micrometer ceramic coat is made to fix at the beginning, and an about 200-micrometer ceramic coat is eventually formed by grinding about 100 micrometers of this front face. Thus, by raising the smooth nature of a ceramic coat by polish, even if the by-product at the time of etching stops being able to adhere to this part easily and adheres to it, it becomes possible to make it exfoliate easily at the time of a maintenance.

[0068] Moreover, although giving hard anodic oxidation coatings to the whole underside of the up electrode 134, and adhering this upper twist ceramic coat 152A to it is also considered, if ceramic coat 152A is adhered on hard anodic oxidation coatings, it becomes easy to separate weakly and is not desirable [that adhesion force]. Moreover, a ceramic coat is not made to adhere to this field promptly, but after damaging an aluminum front face by a glass shot etc. and being made to

strengthen the adhesion force, a ceramic coat may be made to adhere, when cut processing of the hard anodic oxidation coatings is carried out and the natural complexion of aluminum is exposed.
[0069] Moreover, since the diameter is slightly narrowed by ceramic coat 152A to which it adheres here, as for the blow-of-gas hole 131 formed in the underside of the lower electrode 134 as shown in drawing 9 , it is desirable to set up slightly the diameter L2 of the blow-of-gas hole 131 greatly rather than final desired value.
[many] For example, if final desired value of the diameter of the blow-of-gas hole 131 is set to about 0.5mm, in consideration of the amount narrowed by ceramic coat 152A, the diameter L2 will be greatly set as about 0.8mm.
[0070] Furthermore, since the direction of the ceramic coat of the part of level flange 144A tends to receive the damage by the plasma from a vertical part about the side-attachment-wall guard plate 144 as shown also, for example in drawing 10 , especially, thickness L3 of ceramic coat 144A of this level flange 144A is made thick enough, for example, it is set as about 200 micrometers. Moreover, although the distance L4 between the lateral surface of the side-attachment-wall guard plate 144 and a processing container side attachment wall is generally set as 0.5mm, since the plasma enters also into the 0.5mm clearance section and a damage is received, it is desirable [the distance /, or] this to carry out adhesion formation of the ceramic coat 144A also at the lateral-surface [of the side-attachment-wall guard plate 144] and underside side of level flange 144A, as shown in drawing 10 .
[0071] Next, actuation of this example constituted as mentioned above is explained. First, in performing etching processing, Wafer W is laid in the installation side of the top face of a susceptor 124, maintenance immobilization of this is carried out by the clamper 128, the interior is maintained in a predetermined reduced pressure ambient atmosphere, introducing predetermined etching gas in the processing container 122, and it impresses high-frequency voltage between a susceptor 124 and the up electrode 134. In this case, as etching gas, chlorine-based gas, fluorine system gas, etc. are used. Moreover, the shutter member 150 went up, and has closed the long hole 148 for conveyance of the side-attachment-wall guard plate 144, and it has prevented that a gate valve 132 is corroded.
[0072] Thus, by impressing high-frequency voltage, the plasma is located on the processing space S between a susceptor 124 and the up electrode 134, and etching processing of the wafer front face is carried out by the generated active species. Since it adheres to the ceramic coats 152A, 152B, 152C, and 152D by detonation flame spraying by which it is characterized [of this invention], the underside of the up electrode 134 exposed especially to the processing space S at this time, all the front faces of the side-attachment-wall guard plate 144, the medial surface of the shutter member 150, the side attachment wall of a processing container, etc. can raise endurance and corrosion resistance rather than the hard-anodic-oxidation-coatings coat conventionally used for equipment.
[0073] Therefore, it can control being deleted by the plasma substantially, and it can become possible to make it decrease substantially and the yield of a product can also raise generating of particle, and generating of the abnormality discharge accompanying exposure of aluminum natural complexion. By carrying out polish processing of the front face of ceramic coat 152A which adhered to this like the up electrode 134 especially smoothly, even if the by-product generated at the time of plasma treatment stops being able to adhere to this easily and adheres to it, this is easily removable with wiping actuation etc. at the time of a maintenance. Thus, as for polish processing of a ceramic coat, it is desirable to process for all the members in

which not only an up electrode but the ceramic coat was formed. The function in which antisticking of a by-product and easy-ization of clearance of the adhering product can be similarly attained with having mentioned above not only the coat formed by detonation flame spraying when polish processing of the front face of a ceramic coat was carried out especially but when polish processing of the ceramic coat formed by the ion plasma metal spray was carried out can be demonstrated.

[0074] Here, it compares about the sectional view of the ceramic coat by detonation flame spraying used for this invention, and the hard-anodic-oxidation-coatings coat used conventionally and the ceramic coat by the plasma metal spray. Drawing 11 (A) shows the sectional view of the ceramic coat by detonation flame spraying of this invention, drawing 11 (B) shows the sectional view of a hard-anodic-oxidation-coatings coat, and drawing 11 (C) shows the sectional view of the ceramic coat by the plasma metal spray. In the case of the coat it is indicated to drawing 11 (B) and drawing 11 (C) that is clear from drawing, porosity is quite large, and, in the case of the coat by the plasma metal spray especially shown in drawing 11 (C), reaches to a maximum of 4.0% (volume %) and is not desirable. On the other hand, in the case of the ceramic coat by detonation flame spraying of this invention, porosity is as low as a maximum of 2.0% (volume %), and it has brought a good result. Furthermore, in the case of the coat by the plasma metal spray shown in drawing 11 (C) about hardness, Vickers hardness is about 700, but in the case of the coat of this invention shown in drawing 11 (A), Vickers hardness is about 1000 and it becomes clear that endurance has been improved substantially. In addition, the hardness of hard anodic oxidation coatings shown in drawing 11 (B) is one half extent of the coat by the plasma metal spray, and is considerably inferior.

[0075] Moreover, although the ceramic coat was formed in both side-attachment-wall guard plates 144 which protect this for the side attachment wall of the processing container 122 in this example, if the protection feature of the side-attachment-wall guard plate 144 becomes enough, of course, it is not necessary to form a ceramic coat in a processing container side attachment wall. Furthermore, although the above-mentioned example explained the case where mentioned the side-attachment-wall guard plate 144, the shutter member 150, and a clamper 128 as an example, and the ceramic coat by detonation flame spraying was formed in these front faces as components held in a processing container, it is not limited to these, for example, you may make it form the ceramic coat by detonation flame spraying also in the front face of a susceptor 124, or front faces, such as a focal ring which is not illustrated.

[0076] in addition, the thing of a format which is not limited to this, for example, impresses an RF generator to a susceptor although it explained taking the case of the plasma etching system of the format of impressing high-frequency voltage to the up electrode 134 if it was in the above-mentioned example -- or it is applicable to things of all formats, such as a thing of a format which impresses an RF generator to up-and-down two electrodes. Furthermore, as plasma treatment equipment, it is not limited to an etching system but can apply to plasma-CVD equipment, a plasma ashing device, plasma spatter equipment, plasma ion implantation equipment, etc.

[0077]

[Effect of the Invention] As explained above, according to the raw material for vacuum processors and its manufacture approach of this invention, the operation effectiveness which was excellent as follows can be demonstrated. Since it was made to make an aluminum oxide deposit by forming membranes in a vacuum ambient atmosphere according to the 1st invention after carrying out etching processing, the alumite processing by anodic oxidation can be lost, therefore it is precise, and it not

only excels in corrosion resistance, but there can be few impurity metals and it can form the raw material for vacuum processors which moreover has very few aluminum-oxide coats of content moisture. According to the 2nd invention, the raw material for vacuum processors which has an aluminum-oxide [with few impurity metals] coat with few [moreover] rates of a gas evolution can be formed. Therefore, when a vacuum housing is formed using such a raw material for vacuum processors, vacuum suction can be carried out to a high vacuum condition in a short time, and, moreover, metal contamination can be decreased. Since according to the 3rd invention a vacuum housing is formed using the base material for vacuum processors of the shape of a barrel of the vacuum housing which should be formed eventually and it was made to perform etching processing and membrane formation processing, the raw material for vacuum processors which has an aluminum-oxide [with few impurity metals] coat with few [moreover] rates of a gas evolution can be formed without using the special vacuum processor for etching or membrane formation. Since according to the 4th invention it is easily removable at the time of a maintenance even if the by-product generated at the time of plasma treatment stops being able to adhere to it easily and adheres to it, since the front face formed in the front face of the base material for vacuum processors the ceramic coat by the plasma or detonation flame spraying ground evenly, it does not become that generating of particle is controlled and the yield can be improved, either, but a maintenance can be easy-ized. According to the 5th and 6th invention, since the ceramic coat by detonation flame spraying was formed, a degree of hardness is large, and the protective coat which was moreover excellent in the low endurance and the corrosion resistance of porosity can be formed. Therefore, since it can prevent that a member is deleted by the plasma, generating of particle can be controlled substantially. Moreover, the yield of a product can be conjointly raised substantially with the reason which did not generate particle, either, since it was hard to be corroded also to corrosive gas, such as etching gas, therefore was described above.

TECHNICAL FIELD

[Industrial Application] This invention relates to the raw material for vacuum processors which processes for example, a semi-conductor wafer, and its manufacture approach.

PRIOR ART

[Description of the Prior Art] Generally, in order to manufacture a semiconductor integrated circuit, various kinds of processings, such as membrane formation and etching processing, are performed to a wafer. If it explains taking the case of an etching system as equipment which processes this kind For example, in the vacuum processing container fabricated by aluminum, separate a predetermined gap and a counterelectrode is arranged. Laying the semi-conductor wafer which consists of Si on a lower electrode, and passing the etching gas of for example, Cl system in this processing container, the plasma by high frequency is generated between counterelectrodes, and a wafer front face is etched with the reactant ion to produce. For example, when it has a possibility of etching not only a wafer front face but the side attachment wall of a container since [which is used for the above-mentioned

etching gas] corrosive is dramatically strong as for the reactant gas of Cl system, therefore aluminum is used as mentioned above as an ingredient of a processing container, since the corrosion resistance is increased, generally alumite processing is performed to the front face.

EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to the raw material for vacuum processors and its manufacture approach of this invention, the operation effectiveness which was excellent as follows can be demonstrated. Since it was made to make an aluminum oxide deposit by forming membranes in a vacuum ambient atmosphere according to the 1st invention after carrying out etching processing, the alumite processing by anodic oxidation can be lost, therefore it is precise, and it not only excels in corrosion resistance, but there can be few impurity metals and it can form the raw material for vacuum processors which moreover has very few aluminum-oxide coats of content moisture. According to the 2nd invention, the raw material for vacuum processors which has an aluminum-oxide [with few impurity metals] coat with few [moreover] rates of a gas evolution can be formed. Therefore, when a vacuum housing is formed using such a raw material for vacuum processors, vacuum suction can be carried out to a high vacuum condition in a short time, and, moreover, metal contamination can be decreased. Since according to the 3rd invention a vacuum housing is formed using the base material for vacuum processors of the shape of a barrel of the vacuum housing which should be formed eventually and it was made to perform etching processing and membrane formation processing, the raw material for vacuum processors which has an aluminum-oxide [with few impurity metals] coat with few [moreover] rates of a gas evolution can be formed without using the special vacuum processor for etching or membrane formation. Since according to the 4th invention it is easily removable at the time of a maintenance even if the by-product generated at the time of plasma treatment stops being able to adhere to it easily and adheres to it, since the front face formed in the front face of the base material for vacuum processors the ceramic coat by the plasma or detonation flame spraying ground evenly, it does not become that generating of particle is controlled and the yield can be improved, either, but a maintenance can be easy-ized. According to the 5th and 6th invention, since the ceramic coat by detonation flame spraying was formed, a degree of hardness is large, and the protective coat which was moreover excellent in the low endurance and the corrosion resistance of porosity can be formed. Therefore, since it can prevent that a member is deleted by the plasma, generating of particle can be controlled substantially. Moreover, the yield of a product can be conjointly raised substantially with the reason which did not generate particle, either, since it was hard to be corroded also to corrosive gas, such as etching gas, therefore was described above.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] By the way, when performing vacuum processing to a semi-conductor wafer, before processing in order to avoid mixing with the residual gas in a container, and etching gas at the time of processing initiation, vacuum suction of the inside of a processing container is carried out to a high vacuum

condition far lower than a process pressure, for example, 10-5Torr extent, and etching processing is performed, passing etching gas and maintaining a process pressure after that. Therefore, to have in a high vacuum condition as much as possible as one factor for gathering processing effectiveness for a short time is demanded.

[0004] However, if alumite processing is performed to the inside front face of a processing container as mentioned above, generally this alumite processing is formed by anodizing in acid solutions, such as a sulfuric acid, and since sealing by the application-of-pressure steam is moreover performed in order to lessen irregularity of that front face, a lot of moisture will be contained in an alumite coat. Although this alumite coat was excellent in hardness or corrosion resistance, since moisture was included as mentioned above, when vacuum suction of the inside of a container was carried out, this moisture evaporated, gas was emitted, and it had the trouble that it could not have in a high vacuum condition and could not go in a short time.

[0005] This is concretely explained based on drawing 12 and drawing 13 . Drawing showing the system of measurement to which drawing 12 measures the pressure in the vacuum chamber which held the aluminum alloy with which alumite processing of the front face was carried out, and drawing 13 are graphs which show the result of having measured the pressure using the system of measurement shown in drawing 12 .

[0006] While 2 is a vacuum chamber for measurement which consists of stainless steel and the pressure gage 6 is formed in this exhaust air system 4 into drawing 12 , towards that downstream, sequential interposition is carried out and the turbo molecular pump 8 and the rotary pump 10 are constituted possible [vacuum suction]. And the device under test 12 was held in this vacuum chamber 2 for measurement, and the pressure variation when carrying out vacuum suction with the above-mentioned turbo molecular pump 8 and a rotary pump 10 was measured with the pressure gage 6.

[0007] what formed the alumite coat with a thickness of 100 micrometers in the front face of the aluminum alloy which carried out cut finishing as a device under test 12, what performed sealing to this and the thing in which the alumite coat with a thickness of 50 micrometers was formed, and the thing which performed sealing to this -- and only what only carried out cut finishing was used.

[0008] The property when Curve A forming an alumite coat with a thickness of 100 micrometers in drawing 13 , and performing sealing, The property when Curve B forming an alumite coat with a thickness of 100 micrometers, and not performing sealing, The property when the property when Curve C forming an alumite coat with a thickness of 50 micrometers, and performing sealing and Curve D forming an alumite coat with a thickness of 50 micrometers, and not performing sealing and Curve E show the property when performing neither an alumite coat nor sealing only by carrying out cut finishing, respectively.

[0009] When an alumite coat is formed so that clearly from this graph, it becomes clear that much time amount is taken for the rate of a gas evolution to be larger than the case of cut finishing 2-3 or more figures, and to change into the high vacuum condition of 10 to 5 or less Torrs regardless of the thickness and sealing of a coat. Thus, in order to raise hardness and corrosion resistance, when alumite processing was performed to the container inner surface, there was a problem that a high vacuum condition could not be reached in a short time.

[0010] Furthermore, although not only a wafer front face but the alumite coat of a container internal surface will be slightly shaved in an etching process For this reason, the impurity heavy metal contained in an alumite coat, for example, Fe, (iron), A part for the sulfur contained in Cu (copper), Mn (manganese), Mg (magnesium), Cr

(chromium), Zn (zinc), etc. and an acid solution was begun to beat out of the coat, and adhered to the wafer front face, and the trouble of becoming the cause of metal contamination also had it. For example, a metal degree of contamination is 2 1010 pieces/cm by high integration. Although to be the following is demanded, if it is in the above-mentioned alumite coat, it is 2 1012 pieces/cm. It will become the degree of contamination of extent. As for a problem which was described above, quick solution is desired in today when a raise in detailed [of an integrated circuit] and high integration progressed.
[0011] This invention is originated paying attention to the above troubles that this should be solved effectively. The object of this invention is to offer a vacuum housing raw material with few [it is hard and] amounts of gas evolutions, and its manufacture approach.

MEANS

[Means for Solving the Problem] In order to solve the above-mentioned trouble, the 1st invention specified to claim 1 removes the natural oxidation film which forms the base material for vacuum processors with the aluminum alloy containing pure aluminum, and is formed in the front face of this base material for vacuum processors by etching processing, and it constitutes it so that an aluminum oxide may be deposited on the front face of the base material for vacuum processors with which said etching processing was made in a vacuum ambient atmosphere after that.
[0013] In order to solve the above-mentioned trouble, in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, the 2nd invention specified to claim 2 removes the natural oxidation film of the front face of said base material for vacuum processors by etching, after that, deposits an aluminum oxide on this front face in a vacuum ambient atmosphere, and constitutes an aluminum-oxide coat.
[0014] The 3rd invention specified to claim 3 is set to the manufacture approach of the raw material for vacuum processors, in order to solve the above-mentioned trouble. The base material for vacuum processors is formed in the shape of a barrel with the aluminum alloy containing pure aluminum. Next, etching processing removes the natural oxidation film currently formed in the internal surface of said base material for vacuum processors, having sealed the ends of said base material for vacuum processors, and maintaining the interior in a vacuum ambient atmosphere. Then, maintaining said interior in a vacuum ambient atmosphere, it constitutes so that an aluminum oxide may be deposited on said internal surface.
[0015] The 4th invention specified to claim 4 forms in the front face of said base material for vacuum processors the ceramic coat by thermal spraying by which the front face was ground evenly in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, in order to solve the above-mentioned trouble.
[0016] The 5th invention specified to claim 6 forms the ceramic coat by detonation flame spraying in the front face of said base material for vacuum processors in the raw material for vacuum processors containing the base material for vacuum processors which consists of an aluminum alloy containing pure aluminum, in order to solve the above-mentioned trouble.
[0017] In order to solve the above-mentioned trouble, the 6th invention specified to claim 12 is constituted in the manufacture approach of the raw material for vacuum

processors so that the base material for vacuum processors may be formed with the aluminum alloy containing pure aluminum, next a ceramic coat may be formed in the front face of this base material for vacuum processors by detonation flame spraying.

OPERATION

[Function] Since the 1st invention made the aluminum oxide deposit on the front face of the base material for vacuum processors from which the natural oxidation film was removed in a vacuum ambient atmosphere, moisture is not contained in a coat and it can form a precise coat, its hardness to etching can also be large, and it is excellent in corrosion resistance, and, moreover, can make the raw material for vacuum processors also with few rates of a gas evolution. In this case, as an approach of removing the natural oxidation film, usual etching and the sputter etching in the inside of a vacuum ambient atmosphere can be used. Moreover, the formation approach of an aluminum-oxide coat can use CVD (Chemical Vapor Deposition) in the inside of a vacuum ambient atmosphere etc.

[0019] Since the 2nd invention formed the aluminum oxide coat in the front face of the base material for vacuum processors using the approach of the 1st invention, it not only can also raise the hardness and corrosion resistance over etching, but it can carry out eburnation of the structure of this coat, and the rate of a gas evolution can make it low substantially.

[0020] Since the 3rd invention was made to perform processing which formed the object for natural oxidation film clearance, and the vacuum processing room for aluminum-oxide coat formation, and was mentioned above on the front face using the barrel-like base material for vacuum processors, it does not need to form the vacuum processor only for processings. Thus, the vacuum housing which had few rates of a gas evolution and was excellent in corrosion resistance etc. with the base material for vacuum processors of the shape of a barrel by which inner surface processing was carried out since moisture formed few coats can be formed.

[0021] Since the 4th invention specified to claim 4 is flatly fabricated by forming a ceramic coat by the plasma metal spray or detonation flame spraying, and grinding this front face on the surface of a base material, even if the reaction by-product generated, for example at the time of etching stops being able to adhere to a wall surface easily and adheres to it, it can remove this easily at the time of a maintenance, and can control generating of particle substantially.

[0022] Since the 5th invention specified to claims 6 and 12 formed the ceramic coat by detonation flame spraying in the front face of a base material, it can raise the degree of hardness and porosity substantially as compared with the hard anodic oxidation coatings used conventionally, can improve corrosion resistance, and becomes possible [making the endurance high].

EXAMPLE

[Example] One example of the raw material for vacuum processors concerning this invention and its manufacture approach is explained in full detail based on an accompanying drawing below. First, the 1st and 2nd invention is explained. An explanatory view for drawing 1 to explain the manufacture approach of the raw material for vacuum processors concerning the 1st invention and drawing 2 are the

outline block diagrams showing an example of the processor for carrying out 1st invention.
[0024] First, the processor for carrying out 1st invention is explained based on drawing 2 . This processor has two vacuum processing rooms 14 formed with stainless steel etc., i.e., the 1st vacuum processing room, and the 2nd vacuum processing room 16, and it is connected between these by the load lock chamber 18 which has a conveyance function through gate valves G1 and G2. The 1st vacuum processing room 14 performs etching processing to the base material for vacuum processors which consists of an aluminium alloy in this example, and removes the natural oxidation film currently formed in the front face, and the 2nd vacuum processing room 16 deposits a precise aluminum oxide on the front face by CVD, and forms it.
[0025] Therefore, the 1st vacuum processing room 14 has the up electrode 20 and the lower electrode 22 as an installation base which have been arranged by separating a predetermined gap to that interior, on this lower electrode 22, it consists of an aluminum alloy, for example, the tabular base material 24 for vacuum processors is laid. The aluminum alloy specified as an aluminum alloy in JIS here with 98% or more of purity, also including the ingredient which contains aluminum 100% of abbreviation shall also be included.
[0026] While the above-mentioned up electrode 20 is grounded, many blow-of-gas holes 26 are formed in that underside, and it has the function as the gas shower head, and the etching gas supply system 28 which supplies Cl system gas is connected to this head as etching gas. And sequential interposition of the closing motion valve 32, the massflow controller 30 which controls the flow rate of gas, and the source 34 of etching gas is carried out at this gas supply system 28. here -- as etching gas -- Cl2, CCl4, and BCl3 etc. -- although Cl system gas is used, other reactant gas may be used.
[0027] 13.56MHz RF generator 38 is connected to the above-mentioned lower electrode 22 through the matching circuit 36 which attains stabilization of the plasma to generate, and the plasma is stood between the above-mentioned up electrodes 20. Moreover, the evacuation system 40 between which it was placed by the turbo molecular pump which is not illustrated and the rotary pump is connected to the pars basilaris ossis occipitalis of the processing room 14, and it has come to be able to carry out the vacuum suction of the interior.
[0028] The above-mentioned load lock chamber 18 is equipped with the conveyance arm 42 which can be expanded and contracted inside, and can transport now the base material [finishing / processing] 24 for vacuum processors into the 2nd vacuum processing room 16 in the 1st vacuum processing room 14. Moreover, the evacuation system 44 connected to the turbo molecular pump which is not illustrated at the pars basilaris ossis occipitalis of this load lock chamber 18, either or the rotary pump is connected. On the other hand, the vacuum processing room 16 of the above 2nd has the installation base 46 for laying a base material 24 in that interior, and the heating heater 48 for heating a base material 24 at the time of membrane formation is built in this installation base 46.
[0029] The gas shower head 48 for introducing raw gas into the interior above the above-mentioned installation base 46 is formed, and the raw gas supply system 56 by which sequential interposition of the 1st closing motion valve 52, 1st rate controller 50, and source 54 of raw gas was carried out, and the active oxygen supply system 64 by which sequential interposition of the 2nd closing motion valve 60, the 2nd rate controller 58, and the source 62 of oxygen was carried out are connected to this head 48, respectively. And in the middle of this supply system 64, the oxygen activity

machine 68 connected to 13.56MHz RF generator 66 is arranged, and the oxygen which flows in this system can be excited and it can be activated now. As raw gas, a dimethyl aluminum hydride (DMAH), trimethylaluminum (TMA), etc. can be used here. Moreover, the evacuation system 70 connected to the turbo molecular pump which is not illustrated at the pars basilaris ossis occipitalis of this vacuum chamber 16, either or the rotary pump is connected.

[0030] Next, this invention approach performed using the processor constituted as mentioned above is explained. First, as shown in drawing 1 R> 1 (A), cut finishing of the tabular aluminum alloy is carried out at a predetermined dimension, the base material 24 for vacuum processors is formed so that it may become the components of a vacuum housing assembled eventually, and cleaning processing is performed to this front face. Since this was naturally exposed into long duration atmospheric air, the natural oxidation film 72 of aluminum is formed in the front face of this base material 24. In addition, the front face of it being the front face which will be exposed to a vacuum ambient atmosphere after the assembly for vacuum processors which should be processed from this is natural.

[0031] Thus, after laying the base material 24 by which cleaning processing was carried out on the lower electrode 22 in the 1st vacuum processing room 14 shown in drawing 2 R> 2 and making the inside of this into a predetermined vacuum ambient atmosphere, by driving RF generator 38, the plasma is stood between the upper part and the lower electrode 20, and 22, etching processing is performed to a base material front face, and as shown in drawing 1 (B), the natural oxidation film 72 is removed. etching gas -- Cl2, CCl4, and BCl3 etc. -- independent in Cl system gas -- or it mixes -- making -- using -- ****ing -- a process pressure -- several -- it is carried out within the limits of mTorr - 0.5Torr extent -- since about 100-200A of natural oxidation film 72 is generally formed, etching processing is performed until it removes this thoroughly.

[0032] Thus, if etching processing is ended and the natural oxidation film 72 is removed, this base material 24 will be transferred on the installation base 46 of the 2nd vacuum processing room 16 currently similarly beforehand made by the vacuum ambient atmosphere by the conveyance arm 42 through the load lock chamber 18 currently maintained by the vacuum ambient atmosphere. That is, it conveys, without exposing a base material 24 into atmospheric air, in order to prevent formation of the natural oxidation film. Pure aluminum and an aluminum oxide are made to deposit by CVD first at this 2nd vacuum processing room 16.

[0033] First, only DMAH is indoors supplied from the gas shower head 48 as raw gas, heating a base material 24 to predetermined process temperature, for example, 200 degrees C, at the heating heater 48, and maintaining, and initial deposition is performed. At this time, a process pressure is set for example, as 10mTorr extent, and the active oxygen supply system 64 is closed thoroughly, and suspends supply of active oxygen. In addition, the hydrogen of the specified quantity is also supplied with DMAH. As this shows drawing 1 (C), the pure aluminum coat 74 of 100% of purity abbreviation will be formed in the front face of a base material 24. The coat of aluminum single crystal at this time is formed of the following type.

[0034]

2(CH3)2 AlH+H2 ->2aluminum**+4CH4 **, if only predetermined thickness forms this pure aluminum coat 74 next, the condition of having supplied raw gas as mentioned above -- the 2nd closing motion valve 60 of the active oxygen supply system 64 -- supply of an aperture and active oxygen -- starting -- this amount of supply -- the 2nd rate controller 58 -- gradual -- an increase -- it carries out, and it

goes, and as shown in drawing 1 (D) and drawing 1 (E), the aluminum-oxide coat 76 is formed.

[0035] aluminum-oxide aluminum 2O3 in which oxygen was fully contained at the time of formation of this aluminum coat 76 since there were few oxygen contents at the beginning It does not become. **** -- oxygen -- the aluminum oxide 1OO1 liable to lack, for example, aluminum, etc. -- it is formed and an oxygen density goes up -- alike -- following -- for example, aluminum9 O2 ->aluminum8 O3 -> .... aluminum2 O2 ->aluminum 2O3 The amount of content oxygen increases and goes like. And it is aluminum 2O3 of 100% of purity abbreviation eventually. The aluminum-oxide coat 78 will be formed. At this time, it is aluminum 2O3. A coat is formed of the following formulas.

[0036] 2(CH3)2 AlH+3O*+H2 ->aluminum2 O3 **+4CH4 ** (O* shows active oxygen)

The thickness of membrane formation here is aluminum 2O3. The thickness of the aluminum coat 78 sets the thickness of the aluminum-oxide coat 76 whole as about 10 micrometers to several micrometers.

[0037] Moreover, oxygen gas concentration is raised little by little, and the mixing ratio of raw gas and oxygen gas goes so that a final mixing ratio may be set to 4:3. In this case, the capacity of the 2nd vacuum processing room 16 is 5000cm3. When it carries out, in order to obtain DEPORETO (deposition rate) of 1000A / min, the flow rate of DMAH of several 1000 SCCM(s) is passed eventually.

[0038] Thus, by forming the aluminum-oxide coat 76, there is almost no content moisture, and moreover it becomes precise structure, and has stable and sufficient degree of hardness chemically, and the impurity element contained further can also form the raw material 80 for vacuum processors which has very few aluminum-oxide coats 76. Thus, since there are dramatically few rates of a gas evolution of the front face exposed to a vacuum ambient atmosphere by assembling a vacuum housing using the formed raw material 80 for vacuum processors, as compared with the thing of structure, a high vacuum ambient atmosphere can be reached conventionally in a short time. Therefore, it becomes possible for the part and processing effectiveness to increase and to raise a throughput.

[0039] Moreover, when an etching processing container is formed as a vacuum housing, it is hard to be etched from the aluminum oxide coat 76 on the front face of a container being dramatically hard. The oxygen component in a coat can increase gradually and can make the hardness increase from the ability of compactness to be increased further by making active oxygen concentration increase gradually especially. Moreover, since it is conventionally contained in this coat 76 as compared with the case of structure whether impurities, such as heavy metal, are very few even if etched, it becomes possible to control generating of metal contamination substantially. As a result of measuring the impurity in the aluminum-oxide coat 76 formed by this approach, the amount of an impurity is 2 1010 pieces/cm. It was able to become extent and the good result was able to be obtained.

[0040] In the above-mentioned example, in order to remove the natural oxidation film 72, although the usual etching processing was performed, it is not limited to this, for example, sputter etching by Ar gas may be performed. Moreover, on the occasion of membrane formation of the aluminum-oxide coat 76, although DMAH was used as raw gas, it may not be limited to this, but the organic gas containing other aluminum, for example, TMA, may be used, and you may use, not only CVD membrane formation but other membrane formation approaches, for example, PVD membrane formation etc., etc. Furthermore, in this example, although the whole was processed

using two vacuum processing rooms 14 and 16, it is not limited to this but may be made to perform etching processing and aluminum-oxide membrane formation processing in the one vacuum processing interior of a room.
[0041] Moreover, as a vacuum housing assembled using the formed raw material 80 for vacuum processors, it is widely applicable not only to the component of the container exposed not only to a vacuum processor but to a vacuum ambient atmosphere, for example, a load lock chamber, a cassette room, and a cluster tool but the structure in a container, for example, the gas shower head made from aluminum, an installation base, etc. In addition, although the case where held the tabular base material for vacuum processors to the vacuum processing interior of a room in the above-mentioned example, and etching and membrane-formation processing were performed to the front face of this base material was explained, the vacuum processing room which should be processed using the base material for vacuum processors of the shape of a barrel which should serve as a vacuum housing eventually forms so that it may not be limited to this but may explain below, and it may be made etching processing and membrane formation giving this internal surface.
[0042] This is explained based on drawing 3 . In addition, the same sign is attached about the same part as the equipment shown in drawing 2 . 24 in drawing is the base material for vacuum processors fabricated in the shape of a barrel with pure aluminum or an aluminum alloy, and will perform etching processing and membrane formation processing of an aluminum oxide to the inner surface of this base material 24.
[0043] Therefore, lids 84 and 86 are formed in the ends of the base material 24 for vacuum processors of the shape of this barrel possible [sealing of the interior] through the seal members 82, such as an O ring, and a processing container is constituted. The evacuation system 70 which interposed the turbo molecular pump 88 grade on the way is connected to one lid 84, and the gas supply nozzle 90 and the active oxygen supply nozzle 92 which have many blow-of-gas holes 26 are inserted in the lid 86 of another side at the airtight, respectively.
[0044] While the above-mentioned gas supply nozzle 90 is grounded, a gas supply system 94 is connected to this. The etching gas supply system 28 which comes to carry out sequential interposition of the closing motion valve 32 for etching gas, a massflow controller 30, and the source 34 of etching gas of Cl system at this gas supply system 94, The raw gas supply system 56 which comes to carry out sequential interposition of the source 54 of raw gas which stores the 1st closing motion valve 52, 1st rate controller 50, and DMAH, the inert gas closing motion valve 98, the inert gas rate controller 96, and N2 etc. -- the inert gas supply system 102 which comes to carry out sequential interposition of the source 100 of inert gas which stores inert gas is connected, respectively.
[0045] On the other hand, the active oxygen supply source 64 which comes to carry out sequential interposition of the oxygen activity machine 68, the 2nd closing motion valve 60, the 2nd rate controller 58, and the source 62 of oxygen is connected to the above-mentioned active oxygen supply nozzle 92. And the 1st switch 104 for turning on and off 13.56MHz RF generator 66 and this is connected to the above-mentioned oxygen activity machine 68 as an energy source which activates oxygen.
[0046] Moreover, sequential connection of the 2nd switch 106 which opens and closes the matching circuit 36, the 13.56MHz RF generator 38 for plasma generating, and this is made at the above-mentioned base material 24 for vacuum processors, this base material 24 is made into ****** material, and it makes inter-electrode [these] generate the plasma by using the above-mentioned gas supply nozzle 90 as an internal electrode. And the heating heater 48 is wound around the perimeter of the above-

mentioned base material 24 for vacuum processors, sequential connection of the heating power source 108 and the 3rd switch 110 is made at this heating heater 48, and this base material 24 very thing is heated at the time of membrane formation.

[0047] Next, the manufacture approach of the raw material for vacuum processors performed using the equipment constituted as mentioned above is explained. First, the case where etching processing of the internal surface of the barrel-like base material 24 for vacuum processors is carried out is explained. First, vacuum suction of the interior is carried out by the evacuation system 70 at the same time it supplies it to the interior like an aperture and the source 34 of etching gas to the 1st invention, using the closing motion valve 32 for etching gas of the etching gas supply system 28 as etching gas, carrying out control of flow of the Cl system gas, and it maintains in the predetermined processing pressure force.

[0048] In addition, it is made for the 1st closing motion valve 52, the inert gas closing motion valve 98, and the 2nd closing motion valve 60 not to supply closing, DMAH, inert gas, and oxygen into a container, respectively at the time of this etching processing. Moreover, the 3rd switch 110 is also changed into an open condition, and makes the heating heater 48 the idle state. And high-frequency voltage is impressed between the barrel-like base material 24 for vacuum processors, and the gas supply nozzle 90 of this core, the plasma is generated inside a container, etching processing of the whole internal surface of a base material 24 is carried out [the 2nd switch 106 is turned ON in such a condition,], and the natural oxidation film is removed. The process conditions at this time are the same as that of the case of the 1st invention, and abbreviation, and this etching processing corresponds to drawing 1 (A) and drawing 1 (B).

[0049] If this etching processing is completed, it will shift to membrane formation processing of an aluminum oxide film next. First, while the 2nd switch 106 is turned OFF and suspending generating of the plasma, closing the closing motion valve 32 for etching gas further and suspending supply of etching gas, the inert gas closing motion valve 98 is opened. thereby -- N2 like -- inert gas is introduced into a container through the inert gas supply system 102 from the source 100 of inert gas, and it is made to permute by the etching gas which remains in this container If the permutation of etching gas is completed, while closing the inert gas closing motion valve 98 and suspending supply of inert gas, the 3rd switch 110 will be closed, it will energize at the heating heater 48, temperature up of the base material 24 for vacuum processors will be carried out to predetermined process temperature, for example, 200 degrees C, and this temperature will be maintained.

[0050] And DMAH and hydrogen gas for membrane formation are introduced for the 1st closing motion valve 52 into a container through the raw gas supply system 56 by open Lycium chinense from the source 54 of raw gas, and an aluminum coat is formed. It is made not to pass the oxygen for activity like the case of the 1st invention in this phase in early stages of membrane formation. Thereby, a pure aluminum coat is formed all over the etched base material internal surface. If the condition at this time is shown in drawing 1 R> 1 (C), it is the same.

[0051] Thus, if a pure aluminum coat with a thickness of about several micrometers is formed, it will supply into a container from the active oxygen nozzle 92, driving the oxygen activity machine 68 and carrying out [turn ON the 1st switch 104,] control of flow of the activated oxygen at the same time it next opens the 2nd closing motion valve 60 and passes oxygen from the source 62 of oxygen. CVD actuation will be performed by this and an aluminum-oxide coat will be gradually formed on the above-mentioned pure aluminum coat.

[0052] An oxygen content is made to increase as the flow rate of active oxygen makes [increase it gradually and] and supplies like the case of the 1st invention at this time and a presser foot and CVD actuation advance the oxygen content to aluminum low in the formation early stages of an aluminum-oxide coat, and it is aluminum 2O3 of predetermined thickness eventually. An aluminum-oxide coat is made to form. The condition at this time is the same as that of the case where it is shown in drawing 1 (D) and drawing 1 (E). Also in this case, the final flow rate of DMAH and oxygen is the same as that of the 1st invention. Thus, membrane formation of an aluminum-oxide coat is completed and the raw material for vacuum processors is formed.

[0053] And vacuum housings, such as a vacuum processor, a load lock chamber, and a cassette room, will be manufactured using the raw material for vacuum processors of the shape of a barrel formed in this way. Thereby, the raw material for vacuum processors which has a precise and hard aluminum-oxide coat not only with moreover there being few heavy-metal impurities but few rates of a gas evolution can be formed. Since according to such an approach the vacuum processor for etching and membrane formation is formed using the base material for vacuum processors of the shape of a barrel, such as a vacuum processor which should be formed eventually, and it was made to perform etching processing and membrane formation processing to an own wall, it becomes unnecessary to use the special vacuum processor for etching and membrane formation. According to the vacuum processor using the above-mentioned raw material for vacuum processors, as compared with equipment, it could go conventionally that a short time was also to the high vacuum condition of 10-5Torr, and extent of the metal contamination at the time of etching has also been improved substantially.

[0054] In addition, if it was in the above-mentioned example, corrosion resistance and endurance were raised by forming a pure aluminum-oxide coat on the surface of a base material, but it changes to an aluminum oxide, a ceramic coat is formed by detonation flame spraying, and you may make it raise corrosion resistance etc. so that it may explain below.

[0055] Next, the raw material for vacuum processors concerning the 4th thru/or the 6th invention in which the ceramic coat by detonation flame spraying was formed on the base material front face, and its manufacture approach are explained with reference to an accompanying drawing.

[0056] The sectional view showing the vacuum processor assembled using the raw material for vacuum processors which drawing 4 requires for the 4th and 5th invention, The perspective view showing the up electrode used for the equipment which shows drawing 5 to drawing 4 , the perspective view showing the side-attachment-wall guard plate used for the equipment which shows drawing 6 to drawing 4 , An explanatory view for drawing 7 to explain the coating approach of the ceramic coat by detonation flame spraying, the partial expanded sectional view in which drawing 8 shows the mounting section of an up electrode, the partial expanded sectional view in which drawing 9 shows the gas nozzle of an up electrode, and drawing 10 are the partial expanded sectional views showing the mounting section of a side-attachment-wall guard plate. The case where an etching system is taken for an example as a vacuum processor in this example is explained.

[0057] By aluminum etc., it has the processing container 122 fabricated in the shape of a rectangle, and, as for this etching system 120, cylindrical or the susceptor 124 as a lower electrode for laying the semi-conductor wafer W, for example which is a processed object is installed in the interior of this processing container 122 through the insulator 126 on the processing container pars basilaris ossis occipitalis.

[0058] While being grounded, the clamper 128 for holding the periphery section of the laid wafer W mechanically is formed in the periphery of the installation side of this top face, and this susceptor certainly fixes Wafer W on a susceptor 124. While the exhaust air system 130 connected to the vacuum pump which is not illustrated is connected to the pars basilaris ossis occipitalis of the above-mentioned processing container 122 and making vacuum suction of the interior possible, the gate valve 132 which opens and closes Wafer W at the time of taking out and carrying in is formed in the side attachment wall.
[0059] Moreover, the up electrode 132 of the product made from aluminum for example, which was made to counter with the above-mentioned susceptor 124, and was made by shower head structure is formed (refer to drawing 5), 13.56MHz RF generator 138 is connected to this up electrode 132 through a matching box 136, high-frequency voltage is impressed to the head-lining section 123 of the processing container 122 between susceptors 124, and the plasma is stood to it. Moreover, many blow-of-gas holes 131 for turning the introduced gas to the processing interior of a room, and spouting are formed in the underside of this up electrode 132.
[0060] Besides, the section electrode 132 is fabricated by convex downward, the hollow room 139 is established in the interior, and the etching gas supply way 140 which supplies etching gas to this hollow room is connected. Moreover, in this hollow room 139, in order to diffuse the introduced etching gas in the direction of a flat surface, two diffusion plates 142 and 142 which have many air holes are formed.
[0061] Moreover, inside the side attachment wall of the processing container 122, the ring-like side-attachment-wall guard plate 144 of the shape of a cross section of L characters as shown also in drawing 6 is formed, and the processing container wall is protected from corrosive etching gas so that the processing space S may be surrounded. Many free passage holes 146 are formed in level flange 144A of this guard plate 144, and the ambient atmosphere in the processing space S is efficiently led to the exhaust air system 130 through this. Moreover, the long hole 148 for conveyance for carrying out taking-out close [of the conveyance arm and wafer which are not illustrated] to the above-mentioned side-attachment-wall guard plate 144 corresponding to a gate valve 132 is formed.
[0062] Under the side-attachment-wall guard plate 144 with which this long hole 148 for conveyance is formed, in order to open and close the above-mentioned long hole 148 for conveyance, the shutter member 150 made possible by rise and fall is installed. Thus, the ceramic coat by which it is characterized [of this invention formed of detonation flame spraying] is formed in front faces, such as many raw materials 134 for vacuum processors which touch the processing space S of the etching system constituted, for example, an up electrode, the side-attachment-wall guard plate 144, the shutter member 122, and a processing container side attachment wall. That is, the medial surface of the whole abbreviation for the underside of the lower electrode 134, the whole abbreviation for the front face of the side-attachment-wall guard plate 144, and the shutter member 122 and the paries medialis orbitae of a processing container adhere to the ceramic coats 152A, 152B, 152C, and 152D, respectively. As a ceramic coat, aluminum 2O3, an AlN system ceramic, etc. can be used.
[0063] If detonation flame spraying is explained here, as shown in drawing 7 , the supplied ceramic powder ingredient will be adhered to the front face of a base material 158 at the barrel 154 in the air using the high-speed combustion energy with high heat of combustion which acetylene gas and oxygen are supplied, for example, and these mixed gas is exploded with a spark plug 156, and is produced by this. If mixed gas explodes within a barrel 154, this gas temperature rises at about 3300

degrees C, and ceramic powder can be in a half-melting condition by one about 10 times the rate of acoustic velocity by this toward a muzzle, and combustion gas can crash into a base material 158 by one twice [about] the speed of acoustic velocity, and can form the dogged coating coat of 100 microns of thickness numbers in this front face. Therefore, a ceramic coat which was described above to each base material can be formed as this base material 158 by using the substrate for the base material for vacuum processors, for example, the base material for up electrode formation, the base material for side-attachment-wall guard plates, and shutter members, and the base material for processing containers.

[0064] As for each ceramic coat, it is desirable after coat formation in the case of the substrate which has the surface smoothness which is like [with possible polish processing], to carry out polish processing of the front face, and to smooth data, and eventually, the thickness of a ceramic coat is set up so that it may be set to 10-400 micrometers, and porosity is set up to 2% or less, in order to control generating of particle as much as possible. Moreover, purity of the ceramic in a ceramic coat is preferably made into 99.5% or more, and the Vickers hardness number at that time carries out to 900 or more. Moreover, when carrying out polish processing of the front face of a ceramic coat, and the difficulty of adhesion of a by-product and the ease of clearance of an affix are taken into consideration, it is desirable to set the surface roughness of a polished surface as 3 micrometers or less.

[0065] Moreover, if the up electrode 134 is taken for an example, processing of the periphery section of the underside of the up electrode 134 joined to the side-attachment-wall up edge of a processing container as shown in drawing 8 will form hard anodic oxidation coatings 160 in the underside periphery section of the up electrode 134 like the conventional approach a little broad beforehand first from the comparatively difficult thing rather than side-attachment-wall up edge junction width of face. In addition, in order to form hard anodic oxidation coatings 160 in this part, it leaves only the hard anodic oxidation coatings 160 which formed hard anodic oxidation coatings in the whole underside of the up electrode 134, next were described above, and you may make it remove the alumite of other parts by cut processing, and may make it form hard anodic oxidation coatings only in an applicable part selectively.

[0066] Next, ceramic coat 152A by detonation flame spraying is formed in the underside of the up electrode 134 by the approach mentioned above in the whole region except the part of hard anodic oxidation coatings 160. In this case, ceramic coat 152A is formed so that it may pile up the about distance L1 slight at the edge of hard anodic oxidation coatings 160, for example, several mm. Thus, by processing, it can prevent that the natural complexion of the aluminum which constitutes the up electrode 134 is directly exposed to the processing space S.

[0067] And the underside of a susceptor 124 and the up electrode 134 which counters performs polish processing to ceramic coat 152A which was easy to perform polish processing since surface smoothness was dramatically high, therefore adhered to this underside. For example, an about 300-micrometer ceramic coat is made to fix at the beginning, and an about 200-micrometer ceramic coat is eventually formed by grinding about 100 micrometers of this front face. Thus, by raising the smooth nature of a ceramic coat by polish, even if the by-product at the time of etching stops being able to adhere to this part easily and adheres to it, it becomes possible to make it exfoliate easily at the time of a maintenance.

[0068] Moreover, although giving hard anodic oxidation coatings to the whole underside of the up electrode 134, and adhering this upper twist ceramic coat 152A to

it is also considered, if ceramic coat 152A is adhered on hard anodic oxidation coatings, it becomes easy to separate weakly and is not desirable [that adhesion force]. Moreover, a ceramic coat is not made to adhere to this field promptly, but after damaging an aluminum front face by a glass shot etc. and being made to strengthen the adhesion force, a ceramic coat may be made to adhere, when cut processing of the hard anodic oxidation coatings is carried out and the natural complexion of aluminum is exposed.

[0069] Moreover, since the diameter is slightly narrowed by ceramic coat 152A to which it adheres here, as for the blow-of-gas hole 131 formed in the underside of the lower electrode 134 as shown in drawing 9 , it is desirable to set up slightly the diameter L2 of the blow-of-gas hole 131 greatly rather than final desired value. [many] For example, if final desired value of the diameter of the blow-of-gas hole 131 is set to about 0.5mm, in consideration of the amount narrowed by ceramic coat 152A, the diameter L2 will be greatly set as about 0.8mm.

[0070] Furthermore, since the direction of the ceramic coat of the part of level flange 144A tends to receive the damage by the plasma from a vertical part about the side-attachment-wall guard plate 144 as shown also, for example in drawing 10 , especially, thickness L3 of ceramic coat 144A of this level flange 144A is made thick enough, for example, it is set as about 200 micrometers. Moreover, although the distance L4 between the lateral surface of the side-attachment-wall guard plate 144 and a processing container side attachment wall is generally set as 0.5mm, since the plasma enters also into the 0.5mm clearance section and a damage is received, it is desirable [the distance /, or] this to carry out adhesion formation of the ceramic coat 144A also at the lateral-surface [of the side-attachment-wall guard plate 144] and underside side of level flange 144A, as shown in drawing 10 .

[0071] Next, actuation of this example constituted as mentioned above is explained. First, in performing etching processing, Wafer W is laid in the installation side of the top face of a susceptor 124, maintenance immobilization of this is carried out by the clamper 128, the interior is maintained in a predetermined reduced pressure ambient atmosphere, introducing predetermined etching gas in the processing container 122, and it impresses high-frequency voltage between a susceptor 124 and the up electrode 134. In this case, as etching gas, chlorine-based gas, fluorine system gas, etc. are used. Moreover, the shutter member 150 went up, and has closed the long hole 148 for conveyance of the side-attachment-wall guard plate 144, and it has prevented that a gate valve 132 is corroded.

[0072] Thus, by impressing high-frequency voltage, the plasma is located on the processing space S between a susceptor 124 and the up electrode 134, and etching processing of the wafer front face is carried out by the generated active species. Since it adheres to the ceramic coats 152A, 152B, 152C, and 152D by detonation flame spraying by which it is characterized [of this invention], the underside of the up electrode 134 exposed especially to the processing space S at this time, all the front faces of the side-attachment-wall guard plate 144, the medial surface of the shutter member 150, the side attachment wall of a processing container, etc. can raise endurance and corrosion resistance rather than the hard-anodic-oxidation-coatings coat conventionally used for equipment.

[0073] Therefore, it can control being deleted by the plasma substantially, and it can become possible to make it decrease substantially and the yield of a product can also raise generating of particle, and generating of the abnormality discharge accompanying exposure of aluminum natural complexion. By carrying out polish processing of the front face of ceramic coat 152A which adhered to this like the up

electrode 134 especially smoothly, even if the by-product generated at the time of plasma treatment stops being able to adhere to this easily and adheres to it, this is easily removable with wiping actuation etc. at the time of a maintenance. Thus, as for polish processing of a ceramic coat, it is desirable to process for all the members in which not only an up electrode but the ceramic coat was formed. The function in which antisticking of a by-product and easy-ization of clearance of the adhering product can be similarly attained with having mentioned above not only the coat formed by detonation flame spraying when polish processing of the front face of a ceramic coat was carried out especially but when polish processing of the ceramic coat formed by the ion plasma metal spray was carried out can be demonstrated.

[0074] Here, it compares about the sectional view of the ceramic coat by detonation flame spraying used for this invention, and the hard-anodic-oxidation-coatings coat used conventionally and the ceramic coat by the plasma metal spray. Drawing 11 (A) shows the sectional view of the ceramic coat by detonation flame spraying of this invention, drawing 11 (B) shows the sectional view of a hard-anodic-oxidation-coatings coat, and drawing 11 (C) shows the sectional view of the ceramic coat by the plasma metal spray. In the case of the coat it is indicated to drawing 11 (B) and drawing 11 (C) that is clear from drawing, porosity is quite large, and, in the case of the coat by the plasma metal spray especially shown in drawing 11 (C), reaches to a maximum of 4.0% (volume %) and is not desirable. On the other hand, in the case of the ceramic coat by detonation flame spraying of this invention, porosity is as low as a maximum of 2.0% (volume %), and it has brought a good result. Furthermore, in the case of the coat by the plasma metal spray shown in drawing 11 (C) about hardness, Vickers hardness is about 700, but in the case of the coat of this invention shown in drawing 11 (A), Vickers hardness is about 1000 and it becomes clear that endurance has been improved substantially. In addition, the hardness of hard anodic oxidation coatings shown in drawing 11 (B) is one half extent of the coat by the plasma metal spray, and is considerably inferior.

[0075] Moreover, although the ceramic coat was formed in both side-attachment-wall guard plates 144 which protect this for the side attachment wall of the processing container 122 in this example, if the protection feature of the side-attachment-wall guard plate 144 becomes enough, of course, it is not necessary to form a ceramic coat in a processing container side attachment wall. Furthermore, although the above-mentioned example explained the case where mentioned the side-attachment-wall guard plate 144, the shutter member 150, and a clamper 128 as an example, and the ceramic coat by detonation flame spraying was formed in these front faces as components held in a processing container, it is not limited to these, for example, you may make it form the ceramic coat by detonation flame spraying also in the front face of a susceptor 124, or front faces, such as a focal ring which is not illustrated.

[0076] in addition, the thing of a format which is not limited to this, for example, impresses an RF generator to a susceptor although it explained taking the case of the plasma etching system of the format of impressing high-frequency voltage to the up electrode 134 if it was in the above-mentioned example -- or it is applicable to things of all formats, such as a thing of a format which impresses an RF generator to up-and-down two electrodes. Furthermore, as plasma treatment equipment, it is not limited to an etching system but can apply to plasma-CVD equipment, a plasma ashing device, plasma spatter equipment, plasma ion implantation equipment, etc.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is an explanatory view for explaining the manufacture approach of the raw material for vacuum processors concerning the 1st invention.
[Drawing 2] It is the outline block diagram showing an example of the processor for carrying out 1st invention.
[Drawing 3] It is the outline block diagram showing an example of the processor for carrying out 3rd invention.
[Drawing 4] It is the sectional view showing the vacuum processor assembled using the raw material for vacuum processors concerning the 4th and 5th invention.
[Drawing 5] It is the perspective view showing the up electrode used for the equipment shown in drawing 4 .
[Drawing 6] It is the perspective view showing the side-attachment-wall guard plate used for the equipment shown in drawing 4 .
[Drawing 7] It is an explanatory view for explaining the coating approach of the ceramic coat by detonation flame spraying.
[Drawing 8] It is the partial expanded sectional view showing the mounting section of an up electrode.
[Drawing 9] It is the partial expanded sectional view showing the blow-of-gas hole of an up electrode.
[Drawing 10] It is the partial expanded sectional view showing the mounting section of a side-attachment-wall guard plate.
[Drawing 11] It is the sectional view showing the ceramic coat by detonation flame spraying, the ceramic coat by the plasma metal spray, and a hard-anodic-oxidation-coatings coat.
[Drawing 12] A front face is drawing showing the system of measurement which measures the pressure in the vacuum chamber which held the aluminum alloy by which alumite processing was carried out.
[Drawing 13] It is the graph which shows the result of having measured the pressure using the system of measurement shown in drawing 12 .
[Description of Notations]
14 1st Vacuum Processing Room
16 2nd Vacuum Processing Room
18 Load Lock Chamber
20 Up Electrode
22 Lower Electrode
24 Base Material for Vacuum Processors
28 Etching Gas Supply System
38 RF Generator
56 Raw Gas Supply System
64 Active Oxygen Supply System
68 Oxygen Activity Machine
72 Natural Oxidation Film
74 Pure Aluminum Coat
76 Aluminum-Oxide Coat
78 Aluminum 2O3 Aluminum-Oxide Coat
80 Raw Material for Vacuum Processors
92 Active Oxygen Supply Nozzle
102 Inert Gas Supply System
120 Etching System

122 Processing Container
124 Susceptor (Lower Electrode)
128 Clamper
134 Up Electrode
144 Side-Attachment-Wall Guard Plate
150 Shutter Member
152A-152D Ceramic coat
158 Base Material